

CLAIMS

What is claimed is:

1. A latent carbon dioxide gas generating material comprising:
 - (A) layer 1 containing fiber and a binder, having a basis weight of from about 25 gsm to about 100 gsm and having inner and outer surfaces,
 - (B) layer 2 containing a carbon dioxide gas generating composition, having a basis weight of from about 5 gsm to about 300 gsm and having upper and lower surfaces, and
 - (C) layer 3 containing fiber and a binder, having a basis weight of from about 25 gsm to about 100 gsm and having inner and outer surfaces, where the inner surface of layer 1 is in contact with the upper surface of layer 2 and the inner surface of layer 3 is in contact with the lower surface of layer 2.
2. The material of claim 1, further comprising a carrier having a basis weight of from about 10 gsm to about 40 gsm which is in contact with the outer surface of layer 1.
3. The material of one of the previous claims, wherein the fiber of layer 1 is cellulosic fiber, synthetic fiber or a mixture thereof.
4. The material of claim 3, wherein the fiber of layer 1 is cellulosic fiber.
5. The material of one of the previous claims, wherein the binder of layer 1 is a synthetic binder fiber, a latex or a combination thereof.
6. The material of claim 5, wherein the synthetic binder fiber of layer 1 is a bicomponent fiber.
7. The material of one of the previous claims, wherein layer 1 contains from about 60 weight percent to about 95 weight percent fiber and from about 5 weight percent to about 40 weight percent binder, where the weight percentages are based on the total weight of fiber and binder in the layer.

8. The material of one of the previous claims, wherein layer 1 contains a synthetic binder fiber in combination with a latex binder.

5 9. The material of claim 8, wherein the binder of layer 1 is a combination of from about 25 weight percent to about 75 weight percent synthetic binder fiber and from about 75 weight percent to about 25 weight percent latex where the weight percentages are based on the total weight of binder and the weight percent latex includes latex solids and fluid carrier.

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10. The material of one of the previous claims, wherein layer 2 contains a carbon dioxide gas generating composition comprising a weak base and a weak acid.

11. The material of claim 10, wherein the weak acid has a solubility of 0.5
15 g/100 g of water or greater at 30°C, and has a melting point of 30°C or greater.

12. The material of one of the previous claims, wherein layer 2 contains a salt which is convertible into an acid.

20 13. The material of claim 11, wherein the acid is citric acid, tartaric acid, succinic acid, fumaric acid, maleic acid, adipic acid, malic acid, oxalic acid, malonic acid, glutaric acid, phthalic acid, metaphosphoric acid, or wherein the salt which is convertible into an acid is an alkali metal salt of citric acid, tartaric acid, succinic acid, fumaric acid, maleic acid, adipic acid, malic acid, oxalic acid, malonic acid, glutaric acid, phthalic acid, metaphosphoric acid or a mixture thereof.

25 14. The material of claim 10, wherein the weak base contains anionic carbonate or hydrogen carbonate.

30 15. The material of claim 14, wherein the base contains as a cation an alkali metal, an alkaline earth metal or a transition metal.

16. The material of claim 15, wherein the base is, lead carbonate, calcium carbonate, barium carbonate, strontium carbonate, magnesium carbonate, beryllium carbonate, lithium carbonate, sodium carbonate, potassium carbonate, rubidium carbonate, cesium carbonate, lead hydrogen carbonate, calcium hydrogen carbonate, 5 barium hydrogen carbonate, strontium hydrogen carbonate, magnesium hydrogen carbonate, beryllium hydrogen carbonate, lithium hydrogen carbonate, sodium hydrogen carbonate, potassium hydrogen carbonate, rubidium hydrogen carbonate, cesium hydrogen carbonate, or a mixture thereof.

10 17. The material of claim 13, wherein the salt which is convertible into an acid is aluminum sulfate, calcium phosphate, alum, a double salt of an alum, potassium aluminum sulfate, sodium dihydrogen phosphate, potassium citrate, sodium maleate, potassium tartrate, sodium fumarate, .

15 18. The material of claim 10, wherein the acid is citric acid and base is sodium hydrogen carbonate.

19. The material of one of the previous claims, wherein layer 2 contains a carbon dioxide gas generating composition mixed with fiber and binder.

20 20. The material of claim 19, wherein the fiber of layer 2 is cellulosic fiber, synthetic fiber or a mixture thereof.

21. The material of claim 20, wherein the fiber of layer 2 is cellulosic 25 fiber.

22. The material of one of claims 19-21, wherein the binder of layer 2 is a synthetic binder fiber, a latex or a combination thereof.

30 23. The material of claim 22, wherein the synthetic binder fiber of layer 2 is a bicomponent fiber.

24. The material of one of the previous claims, wherein layer 2 contains fiber and binder which are from about 60 weight percent to about 95 weight percent fiber and from about 5 weight percent to about 40 weight percent binder, where the weight percentages are based on the total weight of the fiber and binder in the layer.

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25. The material of one of claims 19-23, wherein layer 2 contains a synthetic binder fiber in combination with a latex binder.

26. The material of claim 24, wherein the binder of layer 2 is a
10 combination of from about 25 weight percent to about 75 weight percent synthetic binder fiber and from about 75 weight percent to about 25 weight percent latex where the weight percentages are based on the total weight of binder and the weight percent latex includes latex solids and fluid carrier.

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27. The material of one of the previous claims, wherein the fiber of layer 3 is cellulosic fiber, synthetic fiber or a mixture thereof.

28. The material of claim 27, wherein the fiber of layer 3 is cellulosic
fiber.

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29. The material of one of the previous claims, wherein the binder of layer 3 is a synthetic binder fiber, a latex or a combination thereof.

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30. The material of claim 29, wherein the synthetic binder fiber of layer 3 is a bicomponent fiber.

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31. The material of claim 27, wherein layer 3 contains from about 60 weight percent to about 95 weight percent fiber and from about 5 weight percent to about 40 weight percent binder, where the weight percentages are based on the total weight of the layer.

32. The material of one of the previous claims, wherein layer 3 contains a synthetic binder fiber in combination with a latex binder.

33. The material of claim 32, wherein the binder of layer 3 is a combination of from about 25 weight percent to about 75 weight percent synthetic binder fiber and from about 75 weight percent to about 25 weight percent latex where
5 the weight percentages are based on the total weight of binder and the weight percent latex includes latex solids and fluid carrier.

34. The material of one of the previous claims, wherein the basis weight of the material is from about 65 gsm to about 500 gsm.
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35. The material of claim 34, wherein the basis weight of the material is from about 65 gsm to about 140 gsm.

36. The material of claim 34, wherein the basis weight of the material is
15 from about 141 gsm to about 300 gsm.

37. The material of claim 34, wherein the basis weight of the material is from about 301 gsm to about 500 gsm.
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38. The material of one of the previous claims, wherein the carbon dioxide gas generating composition is from about 3 weight percent to about 20 weight percent based on the total weight of the material.

39. The material of one of claims 1-37, wherein the carbon dioxide gas
25 generating composition is from about 21 weight percent to about 40 weight percent based on the total weight of the material.

40. The material of one of claims 1-37, wherein the carbon dioxide gas generating composition is from about 41 weight percent to about 60 weight percent
30 based on the total weight of the material.

41. The material of one of the previous claims, wherein the ratio by weight of acid to base in the carbon dioxide gas generating composition is from about 10:1 to about 1:10.

5 42. The material of claim 41, wherein the ratio by weight of acid to base in the carbon dioxide gas generating composition is from about 5:1 to about 1:5.

10 43. The material of one of the previous claims, wherein the ratio of equivalents of acid to equivalents of base in the carbon dioxide gas generating composition is from about 5:1 to about 1:5.

15 44. The material of claim 43, wherein the ratio of equivalent of acid to equivalents of base in the carbon dioxide gas generating composition is from about 3:2 to about 2:3.

20 45. The material of one of the previous claims, wherein the carbon dioxide gas generating composition contains a hydrophilic material with a hygroscopicity of from about 80 weight percent to about 250 weight percent based on the weight of the hydrophilic material at 30°C.

25 46. The material of claim 45, wherein the hydrophilic material is a saccharide or derivative thereof, polyhydric alcohol or derivative thereof, polyacrylamide or derivative thereof, polyelectrolyte or a water absorbing polymer.

30 47. The material of claim 46, wherein the hydrophilic material is erythrose, threose, arabinose, xylose, lyxose, glucose, fructose, mannose, galactose, sorbitol, gluconic acid, sucrose, lactose, maltose, dextrin, amylose or hydroxymethyl cellulose.

48. The material of one of the previous claims, wherein the carbon dioxide gas generating composition contains a hydrophobic material.

30 49. The material of claim 48, wherein the hydrophobic material is a wax, a fatty acid or a salt or ester of a fatty acid.